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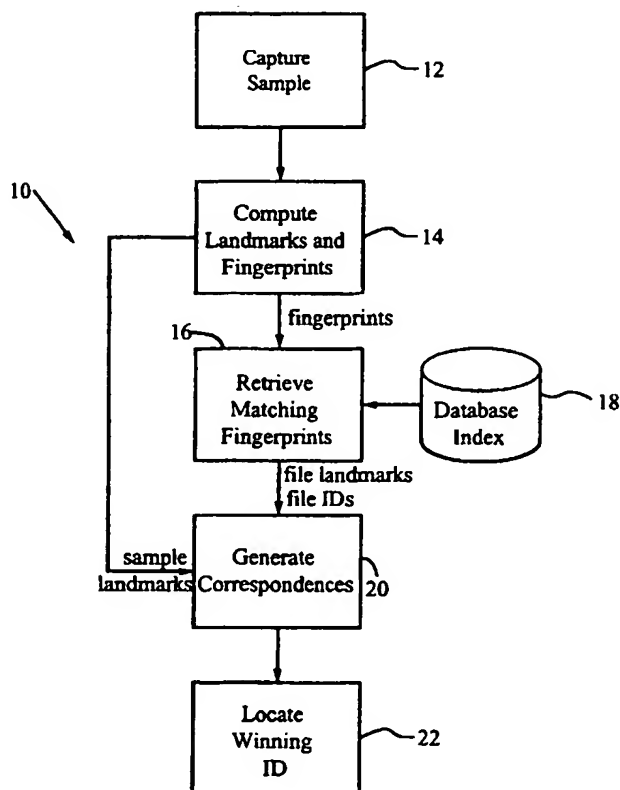
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(54) Title: METHOD FOR SEARCH IN AN AUDIO DATABASE



(57) Abstract: A method for recognizing an audio sample locates an audio file that most closely matches the audio sample from a database indexing a large set of original recordings. Each indexed audio file is represented in the database index by a set of landmark timepoints and associated fingerprints. Landmarks occur at reproducible locations within the file, while fingerprints represent features of the signal at or near the landmark timepoints. To perform recognition, landmarks and fingerprints are computed for the unknown sample and used to retrieve matching fingerprints from the database. For each file containing matching fingerprints, the landmarks are compared with landmarks of the sample at which the same fingerprints were computed. If a large number of corresponding landmarks are linearly related, i.e., if equivalent fingerprints of the sample and retrieved file have the same time evolution, then the file is identified with the sample. The method can be used for any type of sound or music, and is particularly effective for audio signals subject to linear and nonlinear distortion such as background noise, compression artifacts, or transmission dropouts. The sample can be identified in a time proportional to the logarithm of the number of entries in the database; given sufficient computational power, recognition can be performed in nearly real time as the sound is being sampled.

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patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Declarations under Rule 4.17:**

*as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GA, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE,*

*DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)*

*as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii)) for all designations of inventorship (Rule 4.17(iv)) for US only*

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# INTERNATIONAL SEARCH REPORT

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## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G06F17/30 G10H1/00 G10L15/02 G10L15/20

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, INSPEC

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>US 4 852 181 A (MORITO ET AL) 25 July 1989 (1989-07-25)</p> <p>abstract; figures 4,6,7,9,11 column 2, line 30-54</p> <p>---</p> <p>-/--</p>	<p>1-3,5, 8-10,12, 19,20, 34-36, 38-41, 48-51, 76,77</p>

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	LIU S A: "LANDMARK DETECTION FOR DISTINCTIVE FEATURE-BASED SPEECH RECOGNITION" JOURNAL OF THE ACOUSTICAL SOCIETY OF AMERICA, AMERICAN INSTITUTE OF PHYSICS. NEW YORK, US, vol. 100, no. 5, 1 November 1996 (1996-11-01), pages 3417-3430, XP000641690 ISSN: 0001-4966 abstract ---	4, 11, 42-47, 52-55, 68-71
A	US 5 918 223 A (BLUM ET AL) 29 June 1999 (1999-06-29) abstract; figure 7A column 3, line 22-29 ---	1-77
P,X	WO 01 04870 A (FRAGOULIS DIMITRIOS ; PANAGOPOULOS ATHANASIOS (GR); PAPAODY SSEUS CO) 18 January 2001 (2001-01-18) abstract; figures 2, 4, 5 page 1, line 15-25 ---	8
E	WO 01 88900 A (CREATIVE TECH LTD) 22 November 2001 (2001-11-22)  figure 2 page 1, line 10-29 page 2, line 5-30 -----	1-3, 5, 8-10, 12, 19, 20, 34-36, 38-41, 48-51, 76, 77

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP 01/08709

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 4852181	A	25-07-1989	JP 62159195 A	15-07-1987
			JP 62073298 A	03-04-1987
			JP 62073299 A	03-04-1987
			JP 1753825 C	23-04-1993
			JP 4048400 B	06-08-1992
			JP 62086399 A	20-04-1987
			DE 3683343 D1	20-02-1992
			EP 0219712 A1	29-04-1987
			US 4918735 A	17-04-1990
US 5918223	A	29-06-1999	NONE	
WO 0104870	A	18-01-2001	GR 99100235 A	30-03-2001
			EP 1147511 A1	24-10-2001
			WO 0104870 A1	18-01-2001
WO 0188900	A	22-11-2001	WO 0188900 A2	22-11-2001